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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

LOVEL, KIMBERLY M

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/809,244	Applicant(s) GUPTA ET AL.	
	Examiner KIMBERLY LOVEL	Art Unit 2167	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 April 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 8-16 and 25-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8-16 and 25-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 8-16 and 25-28 are rejected. Claims 1-7 and 17-24 have been canceled.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 21 April 2008 has been entered.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 8-11 and 25-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No 6,018,524 to Turner et al (hereafter Turner) in view of US Patent No 7,162,481 to Richardson et al (hereafter Richardson).**

Referring to claim 8, Turner discloses a method for updating a forwarding database [forwarding table], comprising:

forming a hierarchical tree structure having root, branch and leaf nodes that define (i) at least a minimum number (N/T) of sub-databases of the forwarding database and (ii) respective bit combinations associated with the sub-databases (see column 2, lines 12-13; column 4, lines 50-56; Fig 6; and Fig 7);

modifying the hierarchical tree structure in accordance with one or more update operations [insertion strategy] (see column 14, lines 42-43 and Fig 19); and

updating one or more of the sub-databases to reflect modifications made to the hierarchical tree structure, wherein the one or more updated sub-databases corresponds to only those portions of the hierarchical tree affected by the update operation [incremental algorithm done by doing the Insert algorithm for an individual prefix when a new prefix is added] (see column 17, line 60 – column 18, line 34).

Turner fails to explicitly disclose the further limitation of the tree structure wherein each prefix of the N prefixes is stored within one of the databases having an associated bit combination that matches the corresponding bits within the prefix, wherein each of the sub-databases has no more than a pre-determined number (T) of prefixes, and at least one of the sub-databases includes a plurality of the prefixes. Richardson discloses a multi-bit trie, including the further limitation of the tree structure wherein each prefix of the N prefixes is stored within one of the databases having an associated bit combination that matches the corresponding bits within the prefix, wherein each of the sub-databases has no more than a pre-determined number (T) of prefixes, and at least one of the sub-databases includes a plurality of the prefixes (see column 4, lines 20-62 and Fig 3).

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the multi-bit tree structure of Richardson to replace the tree structure of Turner. One would have been motivated to do so in order to improve access speed by utilizing a multi-bit trie (Richardson: see column 1, lines 31-36).

Referring to claim 9, the combination of Turner and Richardson (hereafter Turner/Richardson) discloses the method of claim 8, wherein said forming comprises, beginning with a most significant bit of the N number of prefixes, repeatedly splitting the N number of prefixes into a plurality of nodes extending between and including a root node and a plurality of leaf nodes, and wherein each of the plurality of leaf nodes corresponds to one of the sub-databases (Turner: see column 5, lines 41-62 and Fig 7).

Referring to claim 10, Turner/Richardson discloses the method of claim 9, wherein said modifying comprises performing the update operations on one or more of the plurality of leaf nodes, wherein the update operations are selected from a group comprising: adding [insertion] a new prefix to the forwarding database, deleting an existing prefix from the forwarding database and modifying an existing prefix in the forwarding database (Turner: see column 14, lines 42-43; column 17, line 60 – column 18, line 34 and Fig 19).

Referring to claim 11, Turner/Richardson discloses the method of claim 10, wherein said modifying comprises performing the update operations on one or more of the branch nodes (Turner: see column 14, lines 42-43; column 17, line 60 – column 18, line 34 and Fig 19).

Referring to claim 25, Turner discloses a computer-readable storage medium having recorded therein one or more sequences of instructions which, when executed by a processor, cause the processor to update a forwarding database having a number (N) of prefixes, including causing the processor to:

form a hierarchical tree structure having root, branch and leaf nodes that define (i) at least a minimum number (N/T) of sub-databases of the forwarding database and (ii) respective bit combinations associated with the sub-databases (see column 2, lines 12-13; column 4, lines 50-56; Fig 6; and Fig 7);

modify the hierarchical tree structure in accordance with one or more update operations [insertion strategy] (see column 14, lines 42-43 and Fig 19); and

update one or more of the sub-databases to reflect modifications made to the hierarchical tree structure, wherein the one or more updated sub-databases corresponds to only those portions of the hierarchical tree affected by the update operation [incremental algorithm done by doing the Insert algorithm for an individual prefix when a new prefix is added] (see column 17, line 60 – column 18, line 34).

Turner fails to explicitly disclose the further limitation of the tree structure wherein each prefix of the N prefixes is stored within one of the databases having an associated bit combination that matches the corresponding bits within the prefix, wherein each of the sub-databases has no more than a pre-determined number (T) of prefixes, and at least one of the sub-databases includes a plurality of the prefixes. Richardson discloses a multi-bit trie, including the further limitation of the tree structure wherein each prefix of the N prefixes is stored within one of the databases having an associated

bit combination that matches the corresponding bits within the prefix, wherein each of the sub-databases has no more than a pre-determined number (T) of prefixes, and at least one of the sub-databases includes a plurality of the prefixes (see column 4, lines 20-62 and Fig 3).

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the multi-bit tree structure of Richardson to replace the tree structure of Turner. One would have been motivated to do so in order to improve access speed by utilizing a multi-bit trie (Richardson: see column 1, lines 31-36).

Referring to claim 26, Turner/Richardson discloses the computer readable storage medium of claim 25, wherein the computer readable storage medium is directly coupled to, or incorporated within, the processor, and wherein at least a portion of the sub-database at each leaf nodes is contained within the computer readable storage medium (Turner: see column 15, lines 60-62; column 16, lines 1-10 and Fig 14).

Referring to claim 27, Turner/Richardson discloses the computer readable storage medium of claim 26, wherein the computer readable storage medium comprises random access memory (Turner: see column 15, lines 60-62; column 16, lines 1-10 and Fig 14).

Referring to claim 28, Turner/Richardson discloses the computer readable storage medium of claim 26, wherein, the memory structure comprises one or more of a random access memory, a content-addressable memory, or a network search engine (NSE) (Turner: see column 5, lines 18-31).

5. Claims 12-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No 6,018,524 to Turner et al as in view of US Patent 7,162,481 to Richardson et al as applied to claim 10 above, and further in view of US Patent No 6,735,600 to Andreev et al (hereafter Andreev).

Referring to claim 12, Turner/Richardson discloses modifying the tree structure, however, Turner/Richardson fails to explicitly disclose the further limitations of splitting a leaf node or merging a leaf node. Andreev discloses modifying a tree structure by inserting and deleting entries (see abstract and column 3, lines 43-52), including the further limitation wherein said modifying further comprises one or more of the following steps:

splitting into at least one additional pairs of leaf nodes, a leaf node associated with a sub-database to which a new prefix is to be added and which, upon adding the new prefix would contain more than T prefixes (see column 3, lines 52-58); and

merging with a branch node, a leaf node associated with a sub-database which, upon completion of an update operation, would be left with fewer than a predetermined number of prefixes (see column 3, lines 59-65).

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the steps of splitting and merging the nodes of the tree structure as disclosed by Andreev to modify the tree structure if Turner. One would have been motivated to do so in order to decrease the time it takes to update a tree during insertion or deletion since lookup procedures are a major source of bottlenecks in high-performance routers (see Andreev: column 1, lines 25-30).

Referring to claim 13, the combination of Turner/Richardson and Andreev (hereafter Turner/Richardson/Andreev) discloses the method of claim 12, wherein said merging is performed: if either

(i) the total number of sub-databases defined by the hierarchical tree structure would be, absent said merging, greater than a predetermined number; or

(ii) a predetermined time period has passed, in which no merging was performed (see column 3, lines 54-58; column 4, lines 37-52; and column 7, line 28 – column 8, line 7).

Referring to claim 14, Turner/Richardson/Andreev discloses the method of claim 13, wherein said merging further comprises repeatedly merging the leaf node and the branch node up towards the root node if the total number of prefixes within the leaf node, the branch node and any subsequently merged branch nodes remains less than the minimum number of prefixes (see column 7, lines 28 – column 8, line 7).

Referring to claim 15, Turner/Richardson/Andreev discloses the method of claim 12, wherein said merging is performed only if no other node exists below the branch node that can be paired with the leaf node, such that the combined number of prefixes within the leaf node and the other node is greater than T (see column 3, lines 54-58; column 4, lines 37-52; and column 7, line 28 – column 8, line 7).

Referring to claim 16, Turner/Richardson/Andreev discloses the method of claim 15, wherein, said merging is performed no more than one time in response to an update operation (see column 3, lines 54-58; column 4, lines 37-52; and column 7, line 28 – column 8, line 7).

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- US Patent No 5,575,910 to Bialkowski
- US Patent No 6,571,313 to Filippi et al

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KIMBERLY LOVEL whose telephone number is (571)272-2750. The examiner can normally be reached on 8:00 - 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Cottingham can be reached on (571) 272-7079. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John R. Cottingham/
Supervisory Patent Examiner, Art Unit 2167

Kimberly Lovel
Examiner
Art Unit 2167

5 July 2008
kml